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ABSTRACT

This report summarizes and describes the findings for a number of studies which assess the effects of "Tactics for Thinking," a program designed to teach and reinforce 22 tactics (strategies) for enhancing specific cognitive operations (thinking skills) that aid in the processing, retention, and extension of content-specific information. Part 1 on the report, "Combined Studies," describes those studies that combined two or more of the tactics into a "hybrid" intervention. These studies focused primarily on the effects of the tactics on student achievement as measured by standardized tests or student grades. Part 2 of the report, "Studies on Individual Tactics," summarizes individual studies done to test the hypothesized effect of individual tactics, as follows: attention control, deep processing, power thinking, goal setting, concept attainment and development, pattern recognition, synthesizing, proceduralizing, analogical reasoning, extrapolation, evaluation of evidence, examination of value, decision making, elaboration, nonlinguistic patterns, and everyday problem solving. Forty-two tables of data and one figure are included. An appendix contains estimations for some of the tables. (SR)

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SUMMARY REPORT: EVALUATIONS OF THE TACTICS FOR THINKING PROGRAM

by

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Aurora, Colorado

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INTRODUCTION

Tactics for Thinking (Marzano & Arredondo, 1987) is a program designed to teach and reinforce tactics (strategies) for enhancing specific cognitive operations (thinking skills) that aid in the processing, retention and extension of content-specific information. A formative evaluation was conducted to determine the viability of the strategies within the Tactics program in terms of teacher use and perceived effect on students (Marzano, 1986). Since the formative evaluation, a series of studies have been conducted in an attempt to more accurately assess the effects of each tactic on student performance and the overall effect of the program on student achievement. This report describes and summarizes the findings for those studies.

The Tactics for Thinking program contains 22 strategies meant to be taught to students as tools for processing information presented in content area classrooms. The 22 strategies in the program are listed in Figure 1.

Figure 1

Tactics for Thinking Strategies

1. Attention Control
2. Deep Processing
3. Memory Frameworks
4. Power Thinking
5. Goal Setting
6. The Responsibility Frame
7. Concept Attainment
8. Concept Development
9. Pattern Recognition
10. Macro-Pattern Recognition
11. Synthesizing
12. Proceduralizing
13. Analogical Reasoning
14. Extrapolation
15. Decision Making
16. Evaluation of Evidence
17. Evaluation of Value
18. Elaboration
19. Nonlinguistic Patterns
20. Everyday Problem Solving
21. Academic Problem Solving
22. Invention

Although the Tactics program is commonly thought of as a single program or a single intervention, it is actually a series of interventions that are relatively independent of each other. Many times a district, school, or individual teacher will select a few of the strategies that are taught to students as a set. In such cases, the unique effect of each tactic cannot be partialled out.

Part I of this report describes those studies that combined two or more of the tactics into a "hybrid" intervention. These studies primarily focused on the effects of the tactics on student achievement as measured by standardized tests or student grades. Part II of the report summarizes individual studies done to test the hypothesized effect of individual tactics.

PART I

COMBINED STUDIES

Three studies are reported on the combined effects of the various tactics for thinking.

Study A

The first study was conducted as part of a doctoral dissertation by Detrick (1988) in an "affluent community in California faced with lower test scores in the midst of a state and nationwide call for excellence." Detrick sought to determine the extent to which teachers' instructional behaviors would change as a result of training in the Tactics program, and the extent to which students' scores on standardized tests would be affected by instruction in the tactics. Reported here are the effects of instruction in the tactics on student achievement. (For a detailed discussion of the effects of the program on teacher behavior, see Detrick, 1988.)

Subjects

One volunteer class from grades 3, 4 and 6 at a particular school within the district. According to Detrick, teachers for these classes volunteered for the project after hearing a one-hour presentation of the model. One teacher was a second year teacher, one had five years of experience, one had 14 years of experience, and one had 22 years of experience. Other classes at these grade levels within the school were designated as the control group.

Intervention

The six teachers in the intervention received 15 hours of training in the 22 tactics over a three-week period. Afterward, participating teachers selected those tactics that would best fit their instructional goals. Seven tactics were selected:

1) Attention Control
2) Deep Processing
3) Concept Attainment
4) Pattern Recognition
5) Analogical Reasoning
6) Nonlinguistic Patterns
7) Solving Academic Problems

Monthly meetings of an hour and a half were held following the completion of the initial training to further refine use of targeted tactics. Detrick reports that actual time of use of the tactics in the classroom was seven months.

At the end of the intervention period, students in the experimental and control classes were tested using the Iowa Test of Basic Skills (ITBS). The criterion measure for all subjects was considered to be the composite grade level score on the ITBS as measured by grade level equivalents.

Results

Table 1 reports the comparison of composite ITBS gain scores for the experimental and control groups.

Table 1

Comparison of Gain Scores

Grade/Group	N	Start	End	Gain	Significance
FIRST GRADE					
Experimental	23	1.15	2.37	1.22	
SD		.49	.42		
					NS
Control	37	.99	1.99	1.00	
SD		.47	.56		
THIRD GRADE					
Experimental	25	2.99	3.88	.89	
SD		.96	1.1		
					.05
Control	37	2.69	3.93	1.26	
SD		1.22	1.1		
FOURTH GRADE					
Experimental	25	4.07	5.32	1.23	
SD		.87	.65		
					.001
Control	35	3.98	4.79	.77	
SD		1.23	1.22		
SIXTH GRADE					
Experimental	26	5.96	7.04	1.08	
SD		1.19	1.26		
					.05
Control	26	5.86	6.54	.68	
SD		.88	.95		

As Table 1 indicates, the experimental group outgained the control group in grades 1, 4 and 6; however, the difference was significant only at the fourth and sixth grade levels. Unexpectedly, the control group outgained the experimental group at the third grade level. Closer examination of Table 1 indicates that this might have occurred because of the extreme differences between the experimental and control groups at the beginning of the project. That is, the experimental group at all grade levels had a slightly higher composite grade level score at the start of the intervention. However, at the third grade level the experimental group's score was

substantially higher than the control group's. Table 2 illustrates the differences at the start of the intervention across grade levels.

Table 2

Differences Between Groups at Start of Intervention

Grade	Difference	Group With Higher Score
First	.16	Experimental
Third	.30	Experimental
Fourth	.09	Experimental
Sixth	.10	Experimental

As Table 2 indicates, the control group started out .30 grade levels lower at the third grade. They therefore had an increased probability of more gain simply because they started out lower.

As Table 3 indicates, at the end of the intervention, the experimental groups in grades 1, 4 and 6 were from .38 to .53 grade levels higher than the control group, whereas the control group in grade 3 was only .05 grade levels higher than the experimental. However, when gain scores were compared, the control group's gain was significantly greater than the experimental group's, given the fact that they started so much lower.

Table 3

Differences Between Groups at End of Intervention

Grade	Difference	Group With Higher Score
First	.38	Experimental
Third	.05	Control
Fourth	.53	Experimental
Sixth	.50	Experimental

Detrick further analyzed the data to determine the effects of the tactics on a specific subpopulation of students—those who were below grade level on their composite ITBS scores at the beginning of the intervention. Table 4 illustrates the results of this analysis.

Table 4

Students Below Grade Level Brought to Within Grade Level

Grade	Group	% Below Grade Level Begin Year	% Below Grade Level End Year	% Brought within Grade Level
First	Experimental	30	13	17
	Control	51	19	2
Third	Experimental	64	48	16
	Control	68	59	9
Fourth	Experimental	44	44	0
	Control	57	63	-6
Sixth	Experimental	50	43	7
	Control	46	62	-16

As Table 4 indicates, 16% of the third graders in the experimental group were brought from below grade level to within their grade level by the end of the year, as opposed to 9% in the control group. Hence, even in the class in which the experimental group did not significantly outgain the control group, the students below grade level did outgain their below grade level counterparts in the control group. Similarly, 17% of the first graders in the experimental group were brought to within grade level, as opposed to only 2% in the control group.

Discussion

Even though the Tactics program is not specifically designed to enhance students' performance on standardized tests, it is useful to study its effects on that form of assessment. That is, Tactics is a program designed to enhance students' general information processing skills so that information that is presented in a learning situation is learned more efficiently. Consequently, the various tactics should significantly increase student understanding and retention of the information presented in class by a teacher or textbook. However, there is a growing body of research and theory that indicates that norm referenced standardized tests are measures of highly specific declarative knowledge and not general information

processing skills (Marzano, in press; Marzano & Costa, 1988; Marzano & Jesse, 1987). Hence, if there is not a high level of overlap between the content presented in a classroom and the content within a standardized test, then little gain can be expected in a standardized test even though there might be a substantial amount of learning in the classroom.

The results of Detrick's study imply that the general information processing skills presented in the Tactics program do transfer to the tasks within a standardized test. One would assume that the tasks to which they do transfer are those that require general information processing strategies (e.g., retention and integration of information). This transfer seems particularly important for those students who are below grade level. An explanation for this is that students who are below grade level do not possess even the very basic general informational processing skills that are necessary to complete items on standardized tests. However, students who are at or above grade level have acquired these skills incidentally. Although instruction in the tactics does not increase students' knowledge of the domain-specific information so prominent on standardized tests, it does help students acquire the general information processing skills utilized in those tests.

Study B

A second study on the effects of the Tactics program was conducted in a suburban school district with over 10,000 students. The district is comprised of students from middle and lower-middle income families.

Subjects

All students in the district were considered as subjects for the study since the Tactics program was made available (though not implemented) by all teachers in the district.

Intervention

Five tactics were selected for primary emphasis in the study. They were:

Power Thinking
Deep Processing
Concept Attainment
Concept Development
Pattern Recognition

These tactics were taught to a team of 50 staff developers who were then charged with presenting them to all of the teachers within the district. Although use of the tactics was not required, it was strongly encouraged for all teachers within the district. Along with a presentation of the tactics, the staff developers were presented with specific suggestions as to topics on which the tactics should be applied. These topics were gleaned from an analysis of the standardized test that the district utilized (the Stanford Achievement Test, Form G). In other words, the use of the tactics was coupled with an effort for increased curriculum/test congruence.

Results

Gain scores using Normal Curve Equivalents (NCEs) were calculated for selected subjects within the district using the previous year's scores as the base. Table 5 reports the gains for various subjects within the SAT total battery.

Table 5

Changes in NCE Scores

Test	Change in NCEs from Previous Year	Significance
Word Study Skills	+ 3.71	$p < .05$
Reading Comprehension	+ 2.10	$p < .05$
Vocabulary	+ 3.16	$p < .05$
Spelling	+ .78	NS
Concept of Numbers	+ 4.01	$p < .05$
Math Computation	+ .76	NS
* Total Reading	+ 3.55	$p < .05$
* Total Listening	+ 2.23	NS
* Total Math	+ 4.28	$p < .05$
Math Computations	+ 5.75	$p < .01$
Math Applications	+ 3.14	$p < .05$
Language	+ 3.48	$p < .05$
* Total Language	+ 3.62	$p < .05$
* Social Science	+ 10.73	$p < .001$
* Environment	+ 11.72	$p < .001$
* Science	- 1.78	NS
* Using Information	- 1.88	NS
** Basic Battery	+ 3.91	$p < .05$
** Complete Battery	+ 3.71	$p < .05$

(Note: Section composite scores are designated by an asterisk; total battery composite scores are designated by a double asterisk.)

As Table 5 indicates, scores on the Complete Battery and Basic Battery both rose significantly, as did NCE scores in Total Reading, Math and Language. In all, 17 of the 19 scores in Table 5 rose; 14 of these were significant at the .05 level or higher. Two scores, Science and Using Information, decreased, but not significantly.

Table 6 reports the gain scores in completed battery NCEs by school.

Table 6

Gain Scores by School

School	Change in NCEs From Previous Year	Significance
A) Elementary School	+ 2.40	$p < .05$
B) Elementary School	+ 1.05	NS
C) Elementary School	+ 4.10	$p < .01$
D) Elementary School	+ 4.14	$p < .05$
E) Elementary School	+ 1.22	NS
F) Elementary School	- .83	NS
G) Elementary School	+ .66	NS
H) Elementary School	+ 3.28	$p < .05$
I) Elementary School	+ 1.02	NS
J) Elementary School	+ 4.51	$p < .05$
K) Elementary School	+ 1.75	NS
L) Middle School	+ 5.84	$p < .001$
M) Middle School	+ 1.23	NS
N) Middle School	+ 2.48	$p < .05$
O) Senior High School	+ 5.04	$p < .001$
P) Senior High School	+ 4.97	$p < .01$

As Table 6 indicates, 15 of the 16 schools reported gains in complete battery NCEs; 9 of these 15 were significant at the .05 level or higher. Only one school exhibited a decrease in complete battery NCEs, but this did not prove significant.

Discussion

The results of this study suggest that the Tactics are useful strategies for helping students process domain-specific information of the type that appears on standardized tests. That is, when the domain specific content within a standardized test is the focus of instruction, the tactics help students learn that content in a way that they can retrieve and utilize it within the format of a standardized test. The results in this study are particularly interesting when one considers the fact that for the three years prior to the intervention, students' scores had either gone down or remained the same in spite of efforts within the district to align the curriculum with the test.

Study C

The third study was conducted as part of a college study skills course.

Subjects

Subjects were 34 students in a study skills course at a community college. All students were in their first year of college and were taking the course as part of the required block for all freshmen.

Intervention

The 22 tactics were presented to students over a 10-week period of time. As students were presented with the tactics, they were requested to use them as study strategies for other courses they were taking. They were also asked to keep track of the effectiveness of the tactics.

Results

At the end of the 10-week period, students were administered a questionnaire in which they rated various aspects of the Tactics program. The results of that survey are reported in Table 7.

Table 7
Student Ratings of Effectiveness of Tactics Program

		Agree	Neutral	Disagree
1)	Thinking tactics helped me learn content.	78.6%	15.5%	5.9%
2)	Course required me to think a great deal.	93.2%	5.2%	1.6%
3)	Course improved my thinking skills.	80.8%	17.0%	2.2%
4)	Tactics I learned in this course will help me in other courses.	84.4%	12.7%	2.9%
5)	Tactics I learned in this course will help me in my personal life/work.	82.2%	14.1%	3.7%
6)	All courses should include thinking skills instruction.	73.2%	19.4%	7.4%
7)	I would take another course that included the same or other thinking tactics instruction.	69.5%	23.1%	7.4%

Discussion

As Table 7 indicates, the vast majority of students rated the tactics as helpful to their thinking and useful in processing information in other courses. The instructor for the course also noted that the Tactics program appeared to be more useful and applicable to other courses than any other strategies previously taught in that course.

PART II

STUDIES ON INDIVIDUAL TACTICS

Reported in this section are various studies on the individual tactics. Studies were conducted for 17 of the 22 tactics. Memory Frameworks were not included because of the large body of experimental work that supports its effectiveness (see Bellezza, 1981, for a review). The Responsibility Frame was not included because of its relationship to Attention Control, Power Thinking and Goal Setting. Macro-Pattern Recognition was excluded from the series of studies because of its close relationship to Pattern Recognition. Academic Problem Solving was excluded from analysis because of the large body of research on the various types of problems and their solutions (see Frederiksen, 1984, for a review). Finally, Invention was not included because of the amount of time required for full application of the tactic.

For the most part, the studies reported here were conducted as part of trainings in the Tactics program. These trainings were presented in four (or five) days, spaced from one to four weeks apart. At the end of each training session, volunteers were solicited from the teachers being trained to test specific tactics. These teachers then met with the trainer to establish a design for each study. Whenever possible, Experimental/Control designs were established. Criterion measures were usually teacher-made essay tests for which specific information was targeted as evidence that the tactic in question had an effect on student performance. In all cases, the criterion tests were scored by the teachers, and data were reported on the next scheduled day of training.

In all, 53 studies were attempted on 17 Tactics. However, not all studies yielded interpretable results. For example, in some studies the participating teachers were unsure about the criteria by which student responses were to be evaluated. In other instances, the participating teachers never fully implemented the tactic under consideration. Of the 52 studies, 32 produced interpretable results. Table 8 lists the number of studies that were conducted for each of the 17 Tactics and those with interpretable results.

Table 8

Studies Conducted Versus Those with Interpretable Results

Tactic	Studies Conducted	Studies with Interpretable Results
Attention Control	4	2
Deep Processing	4	3
Power Thinking	4	3
Goal Setting	4	2
Concept Attainment and Development	5	3
Pattern Recognition	4	3
Synthesis	4	2
Proceduralizing	2	1
Analogical Reasoning	2	1
Extrapolation	4	3
Evaluation of Evidence	3	2
Evaluation of Value	3	2
Decision Making	4	2
Elaboration	2	1
Nonlinguistic Patterns	1	1
Everyday Problem Solving	2	1

For a number of these studies, individual student data were not available—only group means and ranges. Therefore, error terms for tests of significance had to be estimated (see Appendix for a description of procedure used to calculate error terms.) The .05 and .01 significance levels were established for all studies.

ATTENTION CONTROL

Attention Control is a tactic for consciously monitoring and controlling one's level of attention. Its hypothesized effect is increased engagement and control of attention. The Attention Control process involves four steps:

1. Become aware of your level of attention.
2. Identify the level of attention required for the task at hand.
3. Compare your level of attention with that required.

4. If necessary, raise your level of attention by raising your energy, bracketing and looking for meaning.

Two studies are reported on the effects of the Attention Control process.

Study A

Subjects

Forty-eight third grade students from two classes, one class of 25 students and one class of 23 students. The class of 25 students was designated as the experimental group; the class of 23 was designated as the control group. Classes were taught by different teachers.

Experimental Condition

The intervention lasted for a period of one week. During that time, students in the experimental group were presented with the Attention Control tactic during a single 30-minute period. They then received practice in the tactic over the next three days, for a period of 30 minutes each day. One week after the intervention engagement, rates were calculated for each student by an observer. Engagement rates were determined by dividing the number of students attending by the number of total students in the class at the time. This rate was calculated in three-minute intervals. An average engagement rate was then calculated for the entire class session and converted to a percentage.

Results

Difference between mean engagement rates for the experimental and control groups were tested using a two-tailed t-test for independent samples. Table 9 reports the results of that comparison.

TABLE 9

Engagement Rate Means for Experimental and Control Groups

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	94.2	1.30	46	4.54	.01
Control	88.3				

As indicated in Table 9, the mean engagement rate for the experimental group was significantly higher than that for the control group ($p < .01$).

Study B

Subjects

Twenty-five high school students from two study skills classes. The 14 students in one class were designated as the experimental group; the 11 students from the other

class were designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Subjects in the experimental group were taught the Attention Control tactic over a three-day interval of time. The tactic was presented during a single class period and then reinforced during the next two classes. Engagement rates for both experimental and control classes were then obtained using a student self-report instrument. Engagement rate data were calculated two days after students had been introduced to and practiced the Attention Control tactic.

Results

Table 10 reports the results of a comparison of the means for the experimental and control classes using a two-tailed t-test for independent samples.

TABLE 10

Engagement Rate Means for Experimental and Control Groups

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	95.1	1.44	23	5.56	.01
Control	87.1				

As Table 10 indicates, the experimental group had a significantly higher mean engagement rate ($p < .01$) than the control group.

Discussion

In both studies the experimental group exhibited higher engagement rates than did the control group after being taught the Attention Control tactic. In addition, the teacher in the experimental class for Study A reported increased incidence of volunteer, student self-reports of their awareness of their own attention levels. Similarly, in Study B, students in the experimental group expressed a heightened level of awareness of their attention levels or lack thereof.

DEEP PROCESSING

Deep Processing is a tactic for creating mental pictures, linguistic information, physical sensation and emotions about information. Its hypothesized effect is increased retention of information. Deep Processing involves four steps:

1. Create a strong mental picture of the information about which you are deep processing.

2. Put the information into words. Talk to yourself about the information; hear yourself talking in your mind's ear.

3. Create some physical sensation about the information. Is there something in the picture to feel, smell, or taste?

4. Generate some emotions about the information. Does it make you excited, angry, or sad?

Three studies are reported on the effects of Deep Processing.

Study A

Subjects

Twenty-one third grade students from a rural elementary school. All students were enrolled in the same class taught by the same teacher. Subjects were randomly divided into two groups: experimental and control. Eleven students were assigned to the experimental group and 10 to the control group.

Experimental Condition

Subjects in the experimental group read a story about which important information was identified and highlighted by the teacher (written on the chalkboard). The teacher then guided students through Deep Processing the highlighted information. Control subjects were not in the room during the activity. Control subjects then read the same story with the same information highlighted. They were asked to "think about" the story for approximately the same period of time that the experimental group "deep processed" the information. Both groups were then administered a 15-item fill-in-the-blank test on the information. The test was read orally by the teacher. The test was then scored by the teacher. Each item was scored using a two-point scale; one point was given for partial answers. Scoring criteria involved inclusion of important information that had been highlighted by the teacher.

Results

The results of a two-tailed t-test for independent samples is reported in Table 11.

TABLE 11

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	27.4	.53	19	6.04	.01
Control	24.2				

As indicated in Table 11, the experimental group had a significantly higher mean score ($p < .01$) on the 15-item multiple choice test.

Study B

Subjects

Forty-three students from two sixth grade social studies classes. Nineteen students were in one class, 24 students in another. The class with 24 students was designated as the experimental group; the class of 19 students was designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Subjects in both classes were asked to read the same section in their social studies text. Experimental subjects were then lead by the teacher in deep processing the important information in the unit. Control subjects were simply asked to "study" the important information orally highlighted by the teacher for a period of time approximately the same as the experimental group engaged in the Deep Processing activity. The next day, experimental and control subjects were administered a five-item essay test on the information in the unit. That test was scored by the teacher using a 100-point scale; 20 points were assigned to each item. Scoring criteria involved inclusion of important information.

Results

Table 12 reports the results of a two-tailed t-test for independent samples.

TABLE 12

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	94.1	1.02	41	4.51	.01
Control	89.5				

As Table 12 indicates, the experimental group's mean was significantly higher ($p < .01$) than that of the control group.

Study C

Subjects

Two classes of 11th grade social studies students. Twenty-five students were in one class; 28 students in the other. The class with 25 students was designated as the control group; the class with 28 students was designated as the experimental group. Both classes were taught by the same teacher.

Experimental Condition

Students from the experimental group were taught the Deep Processing tactic during a one-week interval of time as part of their social studies class. Students from both experimental and control groups were then presented with the same

lecture on a current events topic. Students in the experimental group were provided with a 10-minute block of time in which they were asked to deep process the information from the lecture without any guidance from the teacher. Students in the control group were provided with a 10-minute period of time in which they were asked to "study" the information in the lecture. After the 10-minute interval, students in both groups took a five-item essay examination. The essay examination was scored by the teacher using a 10-point scale per item. Scoring criteria involved the inclusion of the important content from the lecture. One week later, the students in both groups were given the five-item essay examination again and was scored by the teacher using a 10-point scale per item and the same criteria as used previously.

Results

The results of a two-tailed t-test for independent samples for the first administration of the five-item test is reported in Table 13.

TABLE 13

Comparison of Experimental and Control Means for First Administration

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	45.3	.38	51	5.26	.01
Control	43.3				

The mean score for the experimental group was significantly higher ($p < .01$) than that of the control group. Similar, a two-tailed t-test for independent samples on the means for the second administration of the five-item test indicated that the experimental group mean was significantly higher ($p < .01$) than the control group mean (see Table 14).

TABLE 14

Comparison of Experimental and Control Means for Second Administration

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	45.2	.50	51	3.8	.01
Control	43.3				

Discussion

The combined results of the three studies suggest that the Deep Processing tactic improves subjects' abilities to store and retain information. Study C implies that the effects of the process are enhanced over time. That is, the differences in retention and retrieval between use and non-use of the tactic increases as more time elapses from the initial processing of the information. In addition to the

increased ability to recall information, the teachers reported that students in Studies A and B exhibited more engagement in the material they were studying as evidenced by increased questions asked and level of verbal interaction.

POWER THINKING

Power Thinking is a tactic for consciously monitoring and controlling one's attitudes so as to optimize a learning situation. The hypothesized effect is an increased sense of personal control and ability for specific tasks, as well as improved performances on the tasks. The Power Thinking process involves four steps:

1. Identify an attitude or belief you want to integrate into your life.
2. Develop an affirmation for the attitude or belief.
3. Systematically (each day) say the affirmation.
4. As you say the affirmation, use Deep Processing to make the attitude or belief real.

Three studies are reported on the effects of Power Thinking.

Study A

Subjects

Forty-one third grade students in two classes. One class of 21 students was designated as the control group; the class of 20 was designated as the experimental group. Groups were taught by different teachers.

Experimental Condition

Subjects from the experimental group were taught the Power Thinking process by the teacher during a single mathematics class period. The students were then asked to use the Power Thinking process to reinforce the belief that they could succeed in mathematics. The process was practiced each day for three days. Students in the control class engaged in the normal classroom mathematics activities, while students in the experimental group practiced the Power Thinking tactic. Students in both groups were then asked to describe the extent to which they felt like they could succeed in mathematics. These written descriptions were scored by a single teacher for the extent to which they indicated a sense of control on the part of the students. A 50-point scale was used.

Results

Table 15 reports the results of a two-tailed t-test for independent samples.

TABLE 15

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	46.4	.45	39	4.67	.01
Control	44.3				

As Table 15 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Study B

Subjects

Fifty-seven seventh grade students from two classes in a large metropolitan district. The 30 students in one class were identified as the experimental group; the 27 students in the other class were designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Prior to the administration of the end of a unit test, the experimental group rehearsed an affirmation about their success on the upcoming test. For a period of one week, students practiced the affirmation using steps 2 through 4 of the Power Thinking tactic. All rehearsal sessions were lead by the teacher. The end-of-unit test was then administered to both experimental and control classes. The examination consisted of combined essay and "fill-in" questions. The examination was scored by the teacher relative to the extent to which important information in the unit was reported. The test had a possible 100 points.

Results

Table 16 reports the results of a two-tailed t-test for independent samples on the means for the experimental and control groups.

TABLE 16

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	92.3	.93	55	5.59	.01
Control	87.1				

As Table 16 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Study C

Subjects

Thirty-one ninth grade language arts students in a suburban district. All students were taught by the same teacher.

Experimental Condition

Students in the language arts class were presented with the Power Thinking tactic and then guided through the process, by the teacher, for a period of two weeks (three days per week). The affirmation used in the Power Thinking process focused on student academic success. Student scores on teacher-made tests and quizzes were tracked two weeks prior to and two weeks after the rehearsal period.

Results

Mean scores for the class on three teacher-made tests and quizzes prior to the intervention and three teacher-made tests and quizzes after the intervention are reported in Table 17. All scores were converted to a 100-point scale.

TABLE 17

Group Means Prior to and After Introduction of the Tactic

	Pre-Intervention Means			Post-Intervention Means		
	82.1	78.4	81.6	88.2	81.3	85.7

Table 17 indicates that the scores on the teacher-made tests rose after the intervention period, although not in a linear manner. Specifically, scores on the tests rose immediately after the intervention period but then flattened out.

Discussion

The results of the three studies suggest that the Power Thinking tactic can increase students' sense of efficacy and control (Study A) and transfer to increased student achievement (Studies B and C). However, they do not suggest how long the effect lasts since all three studies were of relatively short duration. The only study that tracked results past a single week (Study C) implied that the tactic must be reinforced or the target affirmation systematically rehearsed for the effect to last beyond a few days.

In addition to the effect on test data, the teachers involved in Studies B and C reported an increased awareness on the part of students of the effects (positive and negative) of their "self-talk" on school performance. That is, students in both classes volunteered insights about the negative and positive effect of their self-statements within specific classes and situations.

GOAL SETTING

Goal setting is a tactic for establishing a direction for oneself and then systematically planning and carrying out activities that aid in progress toward that direction. The hypothesized effects of the tactic are increased success in accomplishing explicitly stated goals and increased frequency of goal setting. The Goal Setting tactic involves the following process:

1. State your goal in written form.
2. Identify a time frame in which you plan to accomplish your goal
3. Daily imagine yourself accomplishing your goal.
4. Periodically identify the next steps to take to accomplish your goal.
5. Occasionally review your goal to see if you should change it.
6. When you've reached your goal or have stopped working on it, identify which of your efforts did and did not work.

Two studies are reported on the Goal Setting tactic.

Study A

Subjects

Twenty-five fifth grade students from a rural elementary school. All students were taught by the same teacher in a self-contained classroom.

Experimental Condition

All members of the class were introduced to the long-term Goal Setting tactic by the teacher over a one-week period. Students then were asked to select school-related and nonschool-related month-long goals. To facilitate accomplishing the goals, the Goal Setting process was reviewed two to three times per week. During those periods, the teacher would guide students in reviewing the long-term goals they had selected, evaluate their progress, and plan future activities. At the end of the one-month period, students assessed the extent to which they had accomplished their school-related and nonschool-related goals using a 10-point scale (0 = no progress toward the goal, 10 = accomplished the goal).

Results

Table 18 reports the average scores for student reports of the extent to which school-related and nonschool-related goals were accomplished.

TABLE 18

Mean Scores for Extent to which Goals were Accomplished

	$\bar{x}$	Range
School-Related Goals	7.4	5-10
Nonschool-Related Goals	8.3	6-10

As Table 18 indicates, school-related goals received an average student rating of 7.4 and nonschool-related goals received an average rating of 8.3. Additionally, students were asked to describe in writing their experience of setting and pursuing long-term goals. Of the 25 students, 18 indicated that they felt they had accomplished more relative to either school- or nonschool-related activities than they had accomplished during any previous equivalent time period.

Study B

Subjects

Sixty-three ninth grade students in two science classes at a large metropolitan junior high school. One class of 29 was designated as the experimental group; the other class of 34 was designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Students in the experimental class were presented with the long-term Goal Setting tactic three weeks prior to the midterm examination. Students were then asked to set goals relative to the scores they would like to receive on that examination. Class time was taken two to three times per week for students to review their goals and plan for their attainment. The midterm examination was administered and scored by the teacher. The examination consisted of 50 multiple choice and true/false items. Criteria for scoring included the extent to which answers contained important information covered throughout the term.

Results

The results of a two-tailed t-test for independent samples is reported in Table 19.

TABLE 19

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	46.3	.61	61	6.72	.01
Control	42.2				

As indicated in Table 19, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Discussion

The results of the two studies suggest that the Goal Setting tactic positively affects students abilities to set and attain relatively long-term goals. In addition, students in Study A reported that the skills they had learned in the Goal Setting tactic were used to accomplish other goals they had set in addition to those set for the study. They also reported an increased sense of self-efficacy relative to school- and nonschool-related tasks.

CONCEPT ATTAINMENT AND CONCEPT DEVELOPMENT

Concept Attainment and Concept Development are related tactics for learning and developing new concepts. Concept attainment deals with the initial stages of learning a new concept where the emphasis is on establishing an experiential base for the concept. It involves the following process:

1. Identify a direct or indirect experience you have had relative to the new concept.
2. Describe the new concept in terms of your experiences.
3. Using the information generated in step 1, form a strong mental image of the new concept.
4. Say the word to yourself so you can hear it in your mind's ear.
5. See the word (the orthographic label) in your mind's eye.
6. Systematically review the newly learned concept, adding and deleting information.

Concept development is concerned with sharpening one's knowledge of a concept already attained. It involves the following process:

1. Identify the class or category to which the concept belongs.
2. Identify examples of the concept.
3. Identify concepts similar to it and state how they are similar.
4. Identify concepts dissimilar to it and state how they are dissimilar.
5. Identify the attributes of the concept.
6. Define (not describe) the concept.

The hypothesized effect for Concept Attainment and Concept Development is increased retention of information about concepts and a deeper understanding of concepts. Three studies are reported on Concept Attainment and Concept Development.

Study A

Subjects

Twenty-seven third grade students in a small rural school. All students were taught by the same teacher.

Experimental Condition

Fifteen words were selected from the basal reader used in the third grade class. These words came from the vocabulary building section of the basal. During a one-week period of time, students were taught the words using the procedures recommended in the teacher's manual for the basal. These included reading a definition of the word and using the word in a sentence. At the end of the week, students were tested on their knowledge of the 15 words using a teacher-made test in which students were required to describe the meaning of the word. A second set of 15 words was selected from the basal for the second week. These words were taught using the concept attainment process. Again, students were tested on the words using the same type of teacher-made test. Scoring criteria for both tests included student understanding of the meaning of target words.

Results

Table 20 reports the pre- and post-intervention means on the 15-item test.

TABLE 20

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	9.4	6.15
Post-intervention	13.7	9-15

Table 20 indicates that the post-intervention mean score was higher than the pre-intervention score.

Study B

Subjects

Fifty-three seventh grade students in two social studies classes. Both classes were taught by the same teacher. The class of 27 students was designated as the experimental group; the class of 26 students was designated as the control group.

Experimental Condition

Subjects in the experimental class were taught the concept attainment process over a two-day period. Twenty-five words were then selected from the glossary of the social studies textbook. Students in both groups were requested to learn the words on their own over a one-week period of time. Subjects in the experimental group were instructed to use the Concept Attainment process. In both classes ten minutes were provided at the end of each class period for a one-week interval. During this time students were instructed to study the 25 words. The teacher circulated about the classroom monitoring and assisting students as they studied. In the experimental group, the teacher monitored and encouraged the use of the concept attainment process. On Monday of the succeeding week, students in both groups were given a teacher-made multiple choice and matching test covering the 25 words. The test was then scored by the teacher. Scoring criteria included correct identification of definitions and correct matches to synonyms.

Results

Table 21 reports the results of a two-tailed t-test for independent samples.

TABLE 21

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	23.1	.28	51	6.79	.01
Control	21.2				

Table 21 indicates that the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Study C

Subjects

Forty-two 10th grade students in two science classes. The class of 20 students was designated as the experimental group, while the class of 22 was designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Ten words to which students had been previously introduced were selected for the study. Students in the experimental group were taught the words using the Concept Development tactic. Students in the control group were taught the words by defining each and using it in a sentence. One week after students had been taught the words, they were given a teacher-made test. Within the test, students were asked to define and give an example of each word. The test was then scored by the teacher. Responses to each word were assigned scores from 0 to 5 based on the extent to which the definitions and examples were considered accurate.

Results

Table 22 reports the results of a two-tailed t-test for independent groups.

TABLE 22

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	46.2	.42	40	6.90	.01
Control	43.3				

As indicated in Table 22, subjects from the experimental group had a higher mean score ($p < .01$) than subjects from the control group.

Discussion

The combined results of Studies A and B indicate that the Concept Attainment tactic facilitates and improves retention of information about new concepts from specific content areas. In addition, students in Study B reported that they enjoyed the Concept Attainment tactic and found it useful in learning words in other content areas. That is, some students reported that they had transferred the Concept Attainment process to other content areas. Study C indicates that the Concept Development tactic provides for an in-depth understanding of concepts studied. Specifically, the tactic provided more in-depth knowledge than simply defining and using new concepts in sentences.

PATTERN RECOGNITION

Pattern Recognition is a tactic for organizing linguistic information in meaningful ways. The hypothesized effect is increased ability to organize and comprehend linguistic information. The Pattern Recognition tactic involves the following steps:

1. Look for linguistic patterns in information you read or hear.
2. If you can't find a pattern, adapt (or invent) one that helps you organize the information.

The process assumes an understanding of some basic linguistic patterns for organizing textual and nontextual material. Three studies are reported on the effects of the Pattern Recognition tactic.

Study A

Subjects

Nine third grade students in two different reading groups within the same class. Group designation was based on random assignment for the two-week period of the experimental intervention. The group with five students was designated as the

experimental group, and the group with four students was designated as the control group.

Experimental Condition

Students in the experimental group were taught two linguistic patterns during the first week of the intervention. During this time, students in the control group engaged in reading activities selected from the basal reader. In the middle of the second week, students in both groups were asked to read the same text. Students in the control group were directed to read for the main idea of the story; students in the experimental group were directed to look for and identify linguistic patterns that help them organize the information. One day after the reading of the text, all subjects were tested on their recall of the text material using an oral retelling technique. Retellings were scored by the teacher using a 100-point scale. Scoring criteria included the extent to which subjects reported specific elements of the information within the text.

Results

Table 23 reports the results of a two-tailed t-test of means for independent samples.

TABLE 23

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	88.1	2.4	7	2.83	.05
Control	81.3				

As Table 23 indicates, the experimental group had a significantly higher mean score ($p < .05$) than the control group.

Study B

Subjects

Forty-five sixth grade language arts students in two classes. The class with 24 students was designated as the experimental group; the class with 21 students was designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Students in the experimental class were taught five basic linguistic patterns over a period of two weeks. During this time, students in the control group engaged in exercises from the language arts textbook. Subjects in both classes were then asked to read the same material from a social studies text. Students in the control group were directed to read for important ideas. Students in the experimental group were asked to read for patterns that helped them organize the information. Immediately after reading the chapter, students were given a five-item essay

examination over the material. The examination was scored by the teacher using a 50-point scale. Scoring criteria included the extent to which the student responses included the main ideas in the passage.

Results

Table 24 reports the results of a two-tailed t-test for the mean of independent samples.

TABLE 24

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	45.3	.61	43	5.08	.01
Control	42.2				

As Table 24 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Study C

Subjects

Fifty-four 10th grade students in two English Literature classes. Students in the class of 25 were designated as the experimental group; students in the class of 29 were designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Subjects in the experimental group were taught five basic linguistic patterns over a period of one week. During this same interval of time, subjects in the control group performed standard activities using their literature texts. At the end of the one-week period, students in both groups were presented with a lecture and asked to take notes. Students in the control group were directed to take notes on the important information in the lecture. Students in the experimental group were asked to take notes on the patterns of information they perceived within the lecture. Immediately after the lecture, students in both groups were given a four-item essay test by the teacher over the contents of the lecture. The essay exams were then scored by the teacher using a 25-point scale per item. Scoring criteria included the extent to which students reported salient points within the lecture.

Results

Table 25 reports the results of a two-tailed t-test for the mean of independent samples.

TABLE 25

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	93.2	1.09	52	6.24	.01
Control	86.4				

As Table 25 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Discussion

All three studies suggest that the Pattern Recognition tactic helps students organize information in such a way that it is comprehended and recalled better than without use of the tactic. In addition, students in Study C reported that they found the Pattern Recognition tactic a useful tool for note taking in other classes. That is, a number of students found the tactic useful for organizing information presented in other classes.

SYNTHESIZING

Synthesizing is a tactic for restating large amounts of information in fewer words. The hypothesized effect is an increased ability to recognize important information and to summarize that information in written form. The Synthesizing process involves the following three steps:

1. Identify a pattern that includes important information.
2. Write the information in the pattern in an informal outline or represent it graphically.
3. Rewrite the outlined information in a sentence or two.

Two studies are reported on the effectiveness of the Synthesizing process.

Study A

Subjects

Thirty-five students in a sixth grade language arts class. Seventeen students were randomly selected to constitute the experimental group; the remaining 18 students were designated as the control group. Both groups were taught by the same teacher.

Experimental Condition

Students in the experimental group were taught the Synthesizing tactic over a two-class period interval of time. During this period of time, control subjects worked

with an aide on main idea exercises from their reading textbook. Students in both groups were then given a passage to read and asked to summarize the passage in a sentence or two. The summaries were then scored by the teacher using a 50-point scale. Scoring criteria included the extent to which students' summaries contained the important information within the passage.

Results

Table 26 reports the results of a two-tailed t-test for the mean of independent samples.

TABLE 26

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	47.8	.79	33	4.94	.01
Control	43.9				

As Table 26 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Study B

Subjects

Sixty-one students in two 10th grade social studies classes. Students in the class of 32 were designated as the experimental group; students in the class of 29 were designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Students in the experimental group were taught the Synthesizing process during three class periods over a week's period of time. Students in the control group engaged in exercises from the social studies textbook. Students in both groups were then asked to summarize a section of the social studies text. The teacher scored the written summaries for the extent to which they included important information stated within the text. A 25-point scale was used.

Results

Table 27 reports the results of a two-tailed t-test for means of independent samples.

TABLE 27

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	22.1	.43	59	3.95	.01
Control	20.4				

Table 27 indicates that the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Discussion

Both studies indicate that the Synthesizing tactic helps students recognize and summarize important information. In addition, students in Study B reported that they found the technique useful as a study strategy for tests. Specifically, they found that the strategy enabled them to organize the material they had learned and state the important information in a fashion that made it easier to understand and recall.

PROCEDURALIZING

Proceduralizing is a tactic for breaking a complex process into its component parts and then practicing those component parts to the level of automaticity. The hypothesized effect is increased efficiency at learning procedural or "process" information. The Proceduralizing tactic involves the following steps:

1. Identify the sequence of steps necessary to perform the task.
2. Write the steps down.
3. Before performing the task, read over the procedure you have written and mentally picture yourself performing the procedure.
4. Occasionally revise your procedure, adding or deleting steps to make it better.
5. When the procedure becomes automatic, disregard your description.

One study is reported on the effects of the Proceduralizing process.

Subjects

Forty-eight students in two ninth grade science classes. Students in the class of 27 were designated as the experimental group; students in the class of 21 were designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Students in both classes were presented with a procedure for setting up a science experiment. In both classes, the teacher modeled the process; however, in the experimental group, students were asked to use the Proceduralizing tactic (i.e., record the steps, mentally rehearse them and modify them). After one week, students in both groups were given a three-item essay test on the procedure. The teacher then scored these essay exams using a 30-point scale. Scoring criteria included the extent to which students could accurately describe the process they had been taught. Using a 20-point scale the teacher also rated each student in both classes on their ability to execute the procedure.

Results

Table 28 reports the results of the two-tailed t-test for means from independent samples for the 30-point essay examination. Table 29 reports the results of a two-tailed t-test from independent samples for the 20-point rating of student performance.

TABLE 28

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	26.7	.43	46	6.05	.01
Control	24.1				

TABLE 29

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	18.4	.28	46	4.29	.01
Control	17.2				

As reported in Table 28, the experimental group had a significantly higher mean score ($p < .01$) than the control group in the essay examination covering the process they had been taught. As reported in Table 29, the experimental group again had a significantly higher mean score ($p < .01$) than the control group on the rating of their performance in the process.

Discussion

The results of this study suggest that the Proceduralizing tactic increases student awareness of the procedural knowledge to which it is applied and increases

performance on that procedure. Additionally, the participating teacher indicated that a number of students reported utilizing the Proceduralizing tactic on nonacademic procedures. These students reported that the tactic helped them analyze and learn procedures for which they had been previously experiencing some difficulty.

ANALOGICAL REASONING

Analogical reasoning is a tactic for identifying how the relationship between one set of concepts is similar to the relationship between another set of concepts. The hypothesized effect of the tactic is increased ability to recognize, articulate and construct relationships between sets of concepts. The process for analogical reasoning involves the following three steps:

1. Identify relationships between the two elements in the first set.
2. Identify which element in the first set is most closely related to the single element in the second set.
3. Identify an element that would make the second set of elements have the same relationship as the first set.

One study is reported on the Analogical Reasoning tactic.

Subjects

Forty-one ninth grade students in two social studies classes. The class of 21 students was designated as the experimental group; the class of 20 was designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Students in the experimental group were presented with the format of and tactic for solving analogies during two class periods. During a subsequent class period, students in both groups were then presented with five sets of social studies concepts and asked to identify other sets of social studies concepts that are related in the same way. Students were also asked to explain the perceived relationship (or relationships) in a short paragraph. The explanations were then scored using a 10-point scale for each of the five analogies. Scoring criteria included the extent to which students were able to explain the similarities between relationships found in each set of concepts.

Results

Table 30 reports the results of a two-tailed t-test for means of independent samples.

TABLE 30

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	47.4	.41	39	5.37	.01
Control	45.2				

As Table 30 indicates, the experimental group had a significantly higher mean ($p < .01$) than the control group.

Discussion

The results of this study suggest that once students are presented with the tactic for solving analogies, they can better understand and, therefore, construct and explain analogies. In addition, the teacher reported using the analogy format with students as a way of connecting information they had read in their social studies textbook. Although effects on student understanding of the material was not formally tested, the teacher reported that the analogy format provided a useful vehicle for identifying divergent or unusual relationships between sets of concepts in the reading material.

EXTRAPOLATION

Extrapolation is a process for determining how the semantic pattern from one piece of information is similar at a general level to the pattern from another piece of information. The hypothesized effect is increased ability to recognize and articulate the relationship between seemingly disparate concepts at a general patterning level. Extrapolation involves the following three-step process:

1. Identify a pattern from one piece of information.
2. Disregard some specifics of the pattern and write it in a generalized form.
3. Identify another set of information that fits the same general pattern.

Three studies are reported on the Extrapolation process.

Study A

Subjects

Twenty-four fourth grade students in a self-contained classroom taught by one teacher.

Experimental Condition

During language arts period, students were read a story and asked to describe in writing how the story was similar to another story of their own selection. Students were then taught the Extrapolation process during two class periods. (Students had previously been taught the Pattern Recognition process along with four basic patterns.) Students again read a story and were asked to describe in writing how the story was similar to other stories of their own choosing. The teacher then scored both sets of written descriptions using a 10-point scale. Scoring criteria included the extent to which student explanations identified the general level of relatedness between the selections they had read and those they had chosen.

Results

Table 31 reports the pre- and post-intervention means.

TABLE 31

Comparisons of Pre- and Post-Test Means

	$\bar{X}$	Range
Pre-intervention	8.7	5-10
Post-intervention	5.2	2-10

Table 31 indicates that the students had a higher mean score after the intervention than before.

Study B

Subjects

Forty-seven seventh grade language arts students. The 23 students in one class were designated as the experimental group. The 24 students in the other class were designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Students in the experimental class were taught the Extrapolation process during three class periods. (Students had previously been taught the Pattern Recognition process along with five basic patterns.) Students in both groups were then asked to explain in written form how a current event was similar to an event that had occurred during the civil war. Students' descriptions were then scored by the teacher using a 20-point scale. Scoring criteria included the extent to which student descriptions articulated general levels of relatedness.

Results

Table 32 reports the results of a two-tailed t-test of means from independent samples.

TABLE 32

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	18.7	.24	45	7.91	.01
Control	16.8				

As Table 32 indicates, the experimental group had a significantly higher mean ($p < .01$) than the control group.

Study C

Subjects

Fifty-seven 10th grade students in two social studies classes. The 30 students in one class were designated as the experimental group; the 27 students in the other class were designated as the control group. The same teacher taught both classes.

Experimental Condition

Students in the experimental group were taught the Extrapolation process over a three-class period interval of time. Students in both groups were then presented with three sets of events, all of which had been previously discussed during the course of the semester. Students were asked to describe in writing how the events in each set were similar. Students' written responses were then scored by the teacher using a 15-point scale for each of the comparisons. Scoring criteria included the extent to which student descriptions articulated general levels of relatedness.

Results

Table 33 reports the results of a two-tailed t-test for means of independent samples.

TABLE 33

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	42.4	.36	55	6.39	.01
Control	40.1				

As Table 33 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Discussion

All three studies indicate that the Extrapolation tactic improves students' abilities to discern and articulate abstract relationships between concepts. In addition, the teachers in Studies B and C reported that the process increased both the quantity and quality of the verbal responses by the students relative to comparisons of information. That is, the teachers felt that the Extrapolation tactic provided a vehicle with which students could more readily communicate the relationships they observed. This increased facility then affected their willingness to communicate.

EVALUATION OF EVIDENCE

Evaluation of Evidence is a tactic for determining the validity of claims. The hypothesized effect of the tactic is increased ability to identify errors in the logic of information presented in persuasive situations. It involves the following process:

1. Identify an unusual claim. A claim is a statement. An unusual claim is one that is not self-evident; it is beyond what you know or consider to be common knowledge.

2. Determine if the claim is reasonable, given the context in which it is stated. If it is, it is usually accepted without support.

3. If the claim is not reasonable, determine if it can be supported in its present form. If it can't be supported, the claim is unsubstantiated.

4. If the claim can be supported, determine if support is presented. if no support is presented, the claim is unsubstantiated.

5. If support is presented, determine how reliable it is.

6. If the support is unreliable, the claim is unsubstantiated; if the support is reliable, the claim is substantiated.

Two studies are reported on the Evaluation of Evidence tactic.

Study A

Subjects

Twenty-five 10th grade students in an English Composition class.

Experimental Condition

Students were given a newspaper editorial and asked to critique it for the validity of the argument presented. Students were then presented with the Evaluation of Evidence tactic over a four-class period span of time. After the tactic had been presented, students were asked to critique a second editorial. The pre-intervention and post-intervention critiques were then scored by the teacher using a 50-point

scale. Scoring criteria included the extent to which students were able to identify and articulate errors in the logic of the arguments within the editorials.

Results

Table 34 reports the pre- and post-intervention means.

TABLE 34

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	37.6	31-50
Post-intervention	42.2	38-50

As Table 34 indicates, the post-intervention mean was higher than the pre-intervention mean.

Study B

Subjects

Seven eighth grade students in a developmental reading skills course.

Experimental Condition

Prior to the intervention, students were presented with a newspaper editorial and asked to evaluate the argument presented. Students were then presented with the Evaluation of Evidence process over a three-session interval. Afterward, students were presented with another editorial and again asked to evaluate the argument presented. The teacher scored both pre- and post-intervention essays using a 25-point scale. Scoring criteria included the extent to which students were able to identify and articulate errors in the information within the editorials.

Results

Table 35 reports the pre- and post-intervention means.

TABLE 35

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	16.5	11-25
Post-intervention	22.3	17-25

As is indicated by Table 35, the post-intervention mean was higher than the pre-intervention mean.

Discussion

Both studies indicated an increase in students' abilities to analyze the validity of a persuasive argument after the introduction of the Evaluation of Evidence tactic. Teachers in both studies also reported an increased awareness on the part of the students of examples of informal fallacies in the media. Specifically, students in both classes exhibited a willingness and ability to identify various informal fallacies in the media and discuss these with the teacher and the rest of the class.

EXAMINATION OF VALUE

Examination of Value is a tactic for analyzing the reasoning behind one's own values and identifying the reasoning behind opposing values. The hypothesized effect is increased ability to recognize and articulate one's own values and to describe opposing values. Examination of Value involves a four-step process:

1. Identify whether you consider a concept or statement to be *positive*, *negative*, or *neutral*. Usually your emotional response to the concept or statement will help identify your value evaluation.

2. Identify the assumptions or knowledge base from which you assigned the value rating.

3. Consider the accuracy of the knowledge base for your assumptions.

4. Identify a set of assumptions that might give you a different value weight for the statement or concept.

Two studies are reported on the Examination of Value tactic.

Study A

Subjects

Eleven ninth grade students in a social studies class.

Experimental Condition

Students were presented with a controversial statement and asked to describe in writing their position on that statement. They were also asked to describe in writing a view that is opposed to their own. Students were then presented with the Examination of Value tactic over a two-class period interval of time. Again they were presented with a controversial statement, and asked to describe their position on the statements and to articulate an opposing point of view. Both the pre- and post-intervention essays were then scored by the teacher using a 10-point scale. Scoring criteria included the extent to which student responses described the reasoning behind their values and the reasoning behind an opposing value.

Results

Table 36 displays the pre- and post-intervention means.

TABLE 36

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	7.1	4-10
Post-intervention	9.3	6-10

As is indicated by Table 36, the post-intervention mean was higher than the pre-intervention mean.

Study B

Subjects

Forty-five 11th grade students in two social studies classes. The class with 25 students was designated as the experimental group. The class with 20 students was designated as the control group. Both classes were taught by the same teacher.

Experimental Condition

Students in the experimental group were presented with the Examination of Value tactic over a two-period interval of time. Students in both experimental and control groups were then asked to describe an incident in writing in which they were in disagreement with someone. They were also asked to describe the point of view of the other person. The essays were then scored using a 30-point scale. Scoring criteria included the extent to which student descriptions articulated the reasoning behind their opponents position.

Results

Table 37 reports the results of a two-tailed t-test for means from independent samples.

TABLE 37

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	27.4	.5	43	6.4	.01
Control	24.2				

As Table 37 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Discussion

Both studies indicate an increase in students' abilities to identify and describe their own and opposing positions relative to a specific statement. Teachers in both studies indicated that prior to introducing the Evaluation of Value tactic, students found it difficult to comprehend the concept of articulating an opposing view. When asked to do this on the pre-intervention assessments, some students made little effort to complete the task. However, after the task students exhibited both an increased interest and ability to articulate opposing points of view.

DECISION MAKING

Decision Making is a tactic for systematically selecting among alternatives. The hypothesized effect is increased ability to make a decision according to an identifiable and justifiable criteria. It includes the following components:

1. Identify the attributes important to the alternative you are considering.
2. For each attribute, assign an importance score (very important = 3; moderately important = 2; least important = 1).
3. For each alternative, determine which attributes it possesses and which attributes it does not possess.
4. For each alternative, add up the importance scores to obtain a total score.
5. Determine which alternative has the highest total importance score.
6. Based on your reaction to the selected alternative, determine if you want to change importance scores, or add or drop attributes.
7. If you have changed anything as a result of step 6, keep repeating the process until you obtain an acceptable answer (one that "fits").

Two studies are reported on the effects of the Decision Making tactic.

Study A

Subjects

Fifty-four students from two 10th grade literature classes. The class of 28 students was designated as the experimental group; the class of 26 students was designated as the control group.

Experimental Condition

Students in the experimental group were taught the Decision-Making tactic over an interval of three class periods. Both groups were then asked to respond in writing to a decision-making situation. That is, they were asked to describe how they would go about making a specific decision. The students responses were then scored by the teacher using a 50-point scale. Scoring criteria included the extent to which student responses described the specific criteria used in the decision-making process.

Results

Table 38 reports the results of a two-tailed t-test for means for independent samples.

TABLE 38

Comparison of Experimental and Control Means

	$\bar{x}$	Standard Error	df	t	Significance
Experimental	46.4	.45	52	7.11	.01
Control	43.2				

As Table 38 indicates, the experimental group had a significantly higher mean score ($p < .01$) than the control group.

Study B

Subjects

Thirteen 10th grade students in a literature class.

Experimental Condition

Students were first presented with a hypothetical decision-making situation and asked to describe the decision they would make along with the steps used in the process. They were also asked to defend the logic of their decisions. Students were then presented with the Decision-Making tactic during a two-period interval. Next, students were presented with another decision-making situation and again asked to describe their decision and the process used, and to defend the logic of their decisions. Both the pre- and post-intervention descriptions were then scored by the teacher using a 25-point scale. Scoring criteria included the ability of students to describe the process in which they engaged and defended the reasoning behind their decisions.

Results

Table 39 reports the pre- and post-intervention means.

TABLE 39

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	19.4	16-25
Post-intervention	23.2	19-25

As is indicated in Table 30, the post-intervention mean was higher than the pre-intervention mean.

Discussion

Both studies indicate that the students experienced an increase in ability to make systematic decisions and describe the logic of their decision-making processes after introduction of the tactic. In addition, the teacher in Study B reported an increase in students' awareness of the lack of good decision-making strategies in their daily lives. The teacher commented that students appeared to more readily discuss the decisions they were facing in their personal lives and the strategies (or lack thereof) used in their decision making.

ELABORATION

Elaboration is a set of tactics for systematically inferring unstated qualities of information read or heard. It involves processes for inferring unstated characteristics of concepts and unstated causes and consequences of events. The hypothesized effect is increased ability to make and describe the rationale behind such inferences. The processes involved are:

1. Elaboration of Characteristics:

    a. Identify animate creatures, places, things and events.
    b Using your frame, identify the characteristics that are explicitly stated.
    c. Make a calculated guess about characteristics not explicitly stated.
    d. Justify your inferences.

2. Elaboration of Causes and Consequences:

    a. Identify important states of being or events.
    b. Using your frame, identify causes and consequences that are explicitly stated.
    c. Make a calculated guess about causes and consequences not explicitly stated.
    d. Justify your inferences.

One study is reported on the effects of the Elaboration tactic.

Subjects

Twenty-five sixth grade students in a language arts class.

Experimental Condition

Students were presented with a passage from their basal reader and asked to respond to five elaboration questions in writing. Students were then presented with the Elaboration tactics over a three-class period interval. Afterwards, they were again presented with a passage from their basal reader and again asked five elaboration questions. The teacher then scored both the pre- and post-intervention questions using a 25-point scale (five points for each item). Criteria used to score the essays included the extensiveness of the students' elaborations and the students' abilities to describe the rationale behind their inferences.

Results

Table 40 reports the pre- and post-intervention means.

TABLE 40

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	17.4	13-25
Post-intervention	22.6	18-25

As is indicated by Table 40, the post-intervention mean was higher than the pre-intervention mean.

Discussion

The results of the study indicate an increased ability on the part of students to make and describe the rationale behind characteristic inferences about concepts and causal inferences about events. In addition, the teacher reported an increased willingness to describe inferences on the part of a number of students who characteristically did not respond to inference questions. The teacher hypothesized that the elaboration tactic provided a structure with which students could communicate about their inferences. The existence of the structure increased student motivation to communicate.

NONLINGUISTIC PATTERN RECOGNITION

Nonlinguistic pattern recognition is a series of tactics for solving numeric series problems and figural problems. The hypothesized effect of the tactic is increased ability to solve numeric series and figural problems. The two tactics involve the following steps:

Numeric Series Problems:

1. If the series increases or decreases rapidly, look for a multiplication or division series.

2. If the series does not increase or decrease rapidly, keep applying the V technique, looking for a solution.

3. If no solution can be found, look for a combined addition and multiplication series.

4. If no solution can be found, look for a Fibonacci series.

5. If no solution can be found, look for another type of pattern.

Figural Problems:

1. If the spatial pattern is presented in a matrix, check to see if it is a Latin square matrix. If it is not, try to interpret it as a constant change matrix. If this does not work, look for another pattern of key part changes.

2. If the pattern is not presented in a matrix format, identify the various key parts. Identify a pattern in those changes.

One study is reported on the effects of the Nonlinguistic Pattern Recognition tactics.

Subjects

Twelve seventh and eighth grade students in a study skills class.

Experimental Condition

Students were given a 25-item fill-in-the-blank test containing numeric series and figural problems. Students were then presented with the numeric series and figural problem solving tactics over a four-period interval of time. Afterward, they were presented with another teacher-made 25-item test. Items on both pre- and post-tests were scored as correct or incorrect by the teacher.

Results

Table 41 reports the pre- and post-intervention means.

TABLE 41

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	13.1	9-25
Post-intervention	22.6	15-25

As is indicated by Table 41, the post-intervention mean was higher than the pre-intervention mean.

Discussion

The study suggests that the tactic increased students' abilities to solve numeric series and figural problems. In addition, the teacher reported heightened interest in such problems. Specifically, some students who had not previously expressed an interest in such problems requested an opportunity to do more problems of a similar nature as a part of regular classroom instruction.

EVERYDAY PROBLEM SOLVING

Everyday Problem Solving is a tactic for systematically attacking problems commonly encountered in everyday life. The hypothesized effect is increased awareness of such problems and the ability to solve them. The tactic involves the following steps:

1. Determine whether you really have a problem. Is the goal truly important to you, or can you simply ignore it?

2. If you do have a problem, stop whatever you are doing and try to affirm the following beliefs:

   a. The problem probably has a number of solutions, and you will surely find one or more of them.

   b. If you look for it, help will be available.

   c. You are perfectly capable of taking care of the problem.

3. Begin talking to yourself about the problem. Verbalize the thoughts you are having. (Think aloud about the problem.)

4. Start looking for what is missing and identify possible solutions.

5. For each solution, identify the tools or resources you might need or the actions you might have to take.

6. Determine how accessible the tools (resources, materials, actions) are for each solution. Here is where you might have to look for help.

7. Identify the solutions you think have the highest probability of success and assess the risk factor associated with each solution.

8. Try out the solution that you feel has the highest probability of success and fits your comfort level of risk.

9. If your solution doesn't work, clear your mind and be willing to see the problem in a totally different way. Then go back to step 4. Repeat steps 4 through 8 until you solve the problem.

10. If no solution can be found, "revalue" what you were trying to accomplish. Look for a more basic goal that can be accomplished even though the one at hand cannot.

One study is reported on the effects of the everyday problem-solving tactic.

Subjects

Fifteen eighth grade students in a social studies class.

Experimental Condition

Students were provided with a description of a problem situation and asked to describe in writing the strategies they would use to solve the problem. The students were then presented with the everyday problem-solving tactic over a four-class period interval. Students were then presented with another problem-solving situation and again asked to describe in writing how they would go about solving the problem. The teacher scored both the pre- and post-intervention essays using a 25-point scale. Scoring criteria included: (1) the extent to which students mentioned specific problem-solving heuristics, and (2) the overall effectiveness of the students' problem-solving strategies.

Results

Table 42 reports the pre- and post-intervention means.

TABLE 42

Comparison of Pre- and Post-Test Means

	$\bar{x}$	Range
Pre-intervention	17.4	13-25
Post-intervention	22.6	15-25

As indicated by Table 42, the post-intervention mean was higher than the pre-intervention mean.

Discussion

The results of the study indicated an increased awareness of the general problem-solving heuristics on the part of students and an ability to apply these heuristics to hypothetical problem situations as a result of exposure to the problem-solving tactic. In addition, the teacher reported an increased interest on the part of the students to examine their own problem-solving strategies.

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APPENDIX

When individual student data were not available, the standard error of the differences between means was estimated using the following procedure:

1. Means and ranges were obtained for experimental and control groups.

2. The variance for each group was estimated. Under the assumption that the distributions were normal, the standard deviation was calculated by dividing the range into six equal parts. The variance was estimated by squaring the standard deviation.

Example:

Experimental Group
N = 25
Range = 22-30
$\bar{x}$ = 25.2
Estimated SD = 1.33
Estimated V = 1.33^2 = 1.77

Control Group
N = 24
Range = 18-30
$\bar{x}$ = 22.5
Estimated SD = 2.00
Estimated V = 2.00^2 = 4.00

3. The standard error of the differences between means was then calculated using the formula:

$$S_{Dx} = \sqrt{V_E/N_E + V_C/N_C}$$

Example:
Estimated $S_{Dx} = \sqrt{(1.77/25) + (4.00/24)} = \sqrt{.07 + .17} = .49$

Below are reported the estimations calculated for specific studies summarized in this report.

Estimation for Table 9

$\bar{x}_E$ = 94.2, N = 25
$\bar{x}_C$ = 88.3, N = 23
$Range_E$ = 75-100
$Range_C$ = 71-100
Estimated SD_E = 25/6 = 4.17
Estimated SD_C = 29/6 = 4.83
Estimated $SD_{\bar{x}}$ = 1.30

Estimation for Table 10

$\bar{x}_E$ = 95.1, N = 14
$\bar{x}_C$ = 87.4, N = 11
$Range_E$ = 84-100
$Range_C$ = 75-100
Estimated SD_E = 16/6 = 2.67
Estimated SD_C = 25/6 = 4.17
Estimated $SD_{\bar{x}}$ = 1.44

Estimation for Table 11

$\bar{x}_E$ = 27.4, N = 11
$\bar{x}_C$ = 24.2, N = 10
$Range_E$ = 22-30
$Range_C$ = 23-30
Estimated SD_E = 7/6 = 1.17
Estimated SD_C = 8/6 = 1.33
Estimated $SD_{\bar{x}}$ = .53

Estimation for Table 12

$\bar{x}_E$ =94.1, N = 24
$\bar{x}_C$ =89.5, N = 19
$Range_E$ = 81-100
$Range_C$ = 79-100
Estimated SD_E = 19/6 = 3.17
Estimated SD_C = 21/6 = 3.5
Estimated $SD_{\bar{x}}$ = 1.02

Estimation for Table 13

$\bar{x}_E$ = 45.3, N = 28
$\bar{x}_C$ = 43.1, N = 25
$Range_E$ = 43-50
$Range_C$ = 40-50
Estimated SD_E = 7/6 = 1.17
Estimated SD_C = 10/6 = 1.67
Estimated $SD_{\bar{x}}$ = .38

Estimation for Table 14

$\bar{x}_E$ = 45.2, N = 28
$\bar{x}_C$ = 43.3, N = 25
$Range_E$ = 41-50
$Range_C$ = 31-46
Estimated SD_E = 9/6 = 1.5
Estimated SD_C = 13/6 = 2.17
Estimated $SD_{\bar{x}}$ = .50

Estimation for Table 15

$\bar{x}_E$ = 46.4, N = 20
$\bar{x}_C$ = 44.3, N = 21
$Range_E$ = 43-50 = 7
$Range_C$ = 39-50 = 11
Estimated SD_E = 7/6 = 1.17
Estimated SD_C = 11/6 = 1.83
Estimated $SD_{\bar{x}}$ = .45

Estimation for Table 16

$\bar{x}_E$ = 92.3, N = 30
$\bar{x}_C$ = 87.1, N = 27
$Range_E$ = 84-100
$Range_C$ = 75-100
Estimated SD_E = 16/6 = 2.67
Estimated SD_C = 25/6 = 4.17
Estimated $SD_{\bar{x}}$ = .93

Estimation for Table 19

$\bar{x}_E$ = 46.3, N = 29
$\bar{x}_C$ = 42.2, N = 34
$Range_E$ = 40-50
$Range_C$ = 31-50
Estimated SD_E = 10/6 = 1.67
Estimated SD_C = 19/6 = 3.17
Estimated $SD_{\bar{x}}$ = .61

Estimation for Table 21

$\bar{x}_E$ = 23.1, N = 27
$\bar{x}_C$ = 21.2, N = 26
$Range_E$ = 20-25
$Range_C$ = 17-25
Estimated SD_E = 5/6 = .83
Estimated SD_C = 8/6 = 1.33
Estimated $SD_{\bar{x}}$ = .28

Estimation for Table 22

$\bar{x}_E$ = 46.2, N = 20
$\bar{x}_C$ = 43.3, N = 22
$Range_E$ = 42-50
$Range_C$ = 38-47
Estimated SD_E = 8/6 = 1.33
Estimated SD_C = 9/6 = 1.50
Estimated $SD_{\bar{x}}$ = .42

Estimation for Table 23

$\bar{x}_E$ = 88.1, N = 5
$\bar{x}_C$ = 81.3, N = 4
$Range_E$ = 75-94
$Range_C$ = 60-84
Estimated SD_E = 19/6 = 3.17
Estimated SD_C = 24/6 = 4.00
Estimated $SD_{\bar{x}}$ = 2.4

Estimation for Table 24

$\bar{x}_E$ = 45.3, N = 24
$\bar{x}_C$ = 42.2, N = 21
$Range_E$ = 41-50
$Range_C$ = 35-50
Estimated SD_E = 9/6 = 1.5
Estimated SD_C = 15/6 = 2.5
Estimated $SD_{\bar{x}}$ = .61

Estimation for Table 25

$\bar{x}_E$ = 93.2, N = 25
$\bar{x}_C$ = 86.4, N = 29
$Range_E$ = 81-100
$Range_C$ = 71-100
Estimated SD_E = 19/6 = 3.17
Estimated SD_C = 29/6 = 4.83
Estimated $SD_{\bar{x}}$ = 1.09

Estimation for Table 26

$\bar{x}_E$ = 47.8, N = 17
$\bar{x}_C$ = 43.9, N = 18
$Range_E$ = 41-50
$Range_C$ = 32-50
Estimated SD_E = 9/6 = 1.50
Estimated SD_C = 18/6 = 3.00
Estimated $SD_{\bar{x}}$ = .79

Estimation for Table 27

$\bar{x}_E$ = 22.1, N = 32
$\bar{x}_C$ = 20.4, N = 29
$Range_E$ = 19-25
$Range_C$ = 12-25
Estimated SD_E = 6/6 = 1.00
Estimated SD_C = 13/6 = 2.17
Estimated $SD_{\bar{x}}$ = .43

Estimation for Table 28

$\bar{x}_E$ = 26.7, N = 27
$\bar{x}_C$ = 21.1, N = 21
$Range_E$ = 22-30
$Range_C$ = 20-30
Estimated SD_E = 8/6 = 1.33
Estimated SD_C = 10/6 = 1.67
Estimated $SD_{\bar{x}}$ = .43

Estimation for Table 29

$\bar{x}_E$ = 18.4, N = 27
$\bar{x}_C$ = 17.2, N = 21
$Range_E$ = 15-20
$Range_C$ = 13-20
Estimated SD_E = 5/6 = .83
Estimated SD_C = 7/6 = 1.17
Estimated $SD_{\bar{x}}$ = .28

Estimation for Table 30

$\bar{x}_E$ = 47.4, N = 21
$\bar{x}_C$ = 45.2, N = 20
$Range_E$ = 44-50
$Range_C$ = 40-50
Estimated SD_E = 6/6 = 1.00
Estimated SD_C = 10/6 = 1.67
Estimated $SD_{\bar{x}}$ = .41

Estimation for Table 32

$\bar{x}_E$ = 18.7, N = 23
$\bar{x}_C$ = 16.8, N = 24
$Range_E$ = 17-20
$Range_C$ = 13-20
Estimated SD_E = 4/6 = .67
Estimated SD_C = 7/6 = 1.17
Estimated $SD_{\bar{x}}$ = .24

Estimation for Table 33

$\bar{x}_E$ = 42.4, N = 30
$\bar{x}_C$ = 40.1, N = 27
$Range_E$ = 39-45
$Range_C$ = 35-45
Estimated SD_E = 6/6 = 1.00
Estimated SD_C = 10/6 = 1.67
Estimated $SD_{\bar{x}}$ = .36

Estimation for Table 37

$\bar{x}_E$ =27.4, N = 25
$\bar{x}_C$ =24.2, N = 20
$Range_E$ = 21-30
$Range_C$ = 19-30
Estimated SD_E = 9/6 = 1.50
Estimated SD_C = 11/6 = 1.83
Estimated $SD_{\bar{x}}$ = .5

Estimation for Table 38

$\bar{x}_E$ = 46.4, N = 28
$\bar{x}_C$ = 43.2, N = 26
$Range_E$ = 42-50
$Range_C$ = 38-50
Estimated SD_E = 8/6 = 1.33
Estimated SD_C = 12/6 = 2.00
Estimated $SD_{\bar{x}}$ = .45